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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/574,507	09/05/2006	Jianjun Wang	047911-0103	2372

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EXAMINER	
MEKHLIN, ELI S	

ART UNIT	PAPER NUMBER
1728	

MAIL DATE	DELIVERY MODE
10/24/2011	PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	10/574,507	WANG ET AL.	
	Examiner	Art Unit	
	ELI MEKHLIN	1728	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE *3* MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *26 September 2011*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ An election was made by the applicant in response to a restriction requirement set forth during the interview on _____; the restriction requirement and election have been incorporated into this action.

4)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

5)☒ Claim(s) *57-60,62-76,79 and 80* is/are pending in the application.

5a) Of the above claim(s) _____ is/are withdrawn from consideration.

6)☐ Claim(s) _____ is/are allowed.

7)☒ Claim(s) *57-60, 62-76, 79 and 80* is/are rejected.

8)☐ Claim(s) _____ is/are objected to.

9)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

10)☐ The specification is objected to by the Examiner.

11)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

12)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

13)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

(1)

Continued Examination Under 37 CFR 1.114

A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on September 26, 2011, has been entered.

Claims 57-60, 62-76 and 79-80 are pending before the Office for review.

(2)

Response to Arguments

Applicant's arguments filed September 26, 2011, have been fully considered but they are not persuasive.

Applicant's first argument is that "the skilled artisan would not have understood Wu to teach nanowalls having the recited thickness." This is not persuasive because Wu clearly demonstrates techniques that can be used to grow nanosheets with a thickness of 10 nm or less. Accordingly, Wu's nanosheets have a thickness range that overlaps the claimed range of 2 nm or less. Applicant's argument essentially appears to be that Wu does not explicitly teach nanowalls with a thickness of 2 nm or less. However, this argument conflates the novelty and non-obviousness standards of 35 U.S.C. Sec. 102 and 35 U.S.C. Sec. 103, respectively. The MPEP is clear that, in an

obviousness determination, "where the claimed ranges overlap or lie inside ranges disclosed by the prior art a *prima facie* case of obviousness exists. MPEP 2144.05(I) (internal quotations omitted). Applicant's only attempt to rebut the *prima facie* case is to essentially point out that Wu's teachings are insufficient to anticipate the claimed invention. However, as explained above, Wu teaches a technique that can be used to grow nanowalls with a thickness of less than 10 nm, which covers the range of the claimed invention.

Additionally, as will be explained in further detail below, Wu teaches carbon nanowalls. Silva et al. (U.S. Publication No. 2004/0253167) teaches that a carbon nanotube (CNT) can be considered a series of separated graphene layers. Paragraph 6. Accordingly, a carbon nanowall, which is an un-rolled CNT, as taught by Wu, can also be considered to be a series of grapheme layers. In this sense, the carbon nanowalls taught by Wu can be considered to be a series of separated graphene layers because there is no structural attachment between each graphene layer in the series. Moreover, each individual graphene layer is a single layer that has the requisite thickness of 2 nm or less or 1 nm or less. Accordingly, Wu teaches a plurality of carbon nanosheets, packed together in the form of carbon nanowalls, which are aligned and standing on their edges vertically to a substrate that can be considered individual graphene layers with the requisite thickness.

Applicant next argues that evidence demonstrates a significant in the physical and chemical properties of a carbon nanosheet having a thickness of 2 nm or less as claimed and the disclosed carbon nanowalls having a thickness of 10 nm. First,

Examiner notes that Applicant's statement of the argument is a mischaracterization of Wu's teachings. As explained above, Wu teaches carbon nanowalls having a thickness of 10 nm or less. Applicant relies on Raman spectroscopy to point out the differences in the physical and chemical properties of the nanosheets and nanowalls. However, as under stood by Examiner, the Raman spectroscopy is merely a characterization mechanism that is indicative of the structure of the nanowalls or nanosheets, respectively. Accordingly, the Raman spectra relied upon by Applicant, from Figure 1 of the Specification and Wu, merely points out that Wu's paper explicitly discloses a carbon nanowall with a thickness of 10 nm while also providing a technique for producing carbon nanowalls with a thickness of less than 10 nm. This Raman spectra does not establish any difference in the physical or chemical properties of Applicant's claimed nanosheet or Wu's full disclosure regarding nanowalls. Moreover, the Raman spectra does not begin to address the fact that, as per the MPEP, "where the only difference between the prior art and the claims [is] a recitation of the relative dimensions of the claimed device and a device having the claimed relative dimensions would not perform differently than the prior art device, the claimed device [is] not distinct from the prior art device." MPEP 2144.04(IV)(A).

Applicant next relies on several references filed in an Information Disclosure Statement to establish that the "physical properties of carbon nanostructures are markedly different for single-layer graphene and nanostructures comprising a few layers of graphene relative to carbon structures containing many layers, such as 10 nm thick carbon nanowalls. First, Examiner notes that it is not clear that Applicant's offered

evidence is commensurate in scope with the claimed invention. Second, all of the cited references are after Applicant's time of invention. Specifically, Applicant's evidence of unexpected results regarding the difference in physical properties between the different carbon nanostructures relies on information that is not in the Specification. Additionally, these references have publication dates that are after Applicant's time of invention. Accordingly, these references are not persuasive.

Therefore, Applicant's arguments are not persuasive.

(3)

Claim Rejections - 35 USC § 103

The text of those sections of Title 35, U.S. Code not included in this action can be found in a prior Office action.

Claims 57-59, 75 and 79 are rejected under 35 U.S.C. 103(a) as being unpatentable over Wu et al., *Adv. Mater.* **2002**, *14*, No. 1, January 4, Pages 64-67. Silva et al. (U.S. Publication No. 2004/0253167) will be used to support a statement of fact.

With respect to **claim 57**, Wu teaches a plurality of carbon nanowalls (nanosheets) grown on a substrate wherein the plurality of nanowalls are aligned and stand on their edges vertically to the substrate. Page 64, Col. 2, Second Paragraph and Figure 1b. Wu further teaches that the synthesis technique for the nanowalls can produce nanowalls with a thickness of less than 10 nanometers. Page 65, Bottom of First Full Paragraph. As per the MPEP, "where the claimed ranges overlap or lie inside ranges disclosed by the prior art a *prima facie* case of obviousness exists. MPEP

2144.05(I) (internal quotations omitted). Furthermore, Wu describes the nanowalls as nanoflakes. Page 65, Bottom of First Full Paragraph.

Additionally, the Federal Circuit has made clear that "where the only difference between the prior art and the claims [is] a recitation of the relative dimensions of the claimed device and a device having the claimed relative dimensions would not perform differently than the prior art device, the claimed device [is] not distinct from the prior art device." MPEP 2144.04(IV)(A).

Finally, the nanowalls taught by Wu can be considered to be individual graphene layers that are separated from one another. Silva supports this statement of fact. Specifically, Silva teaches that carbon nanotubes comprise separated graphene layers. Paragraph 6. Accordingly, Wu's nanowalls can be considered a grouping of individual graphene layers, meaning Wu teaches a plurality of carbon nanosheets having a thickness below 1 nm or less wherein the nanosheets are aligned and stand on their edges roughly vertically to a substrate.

With respect to **claim 58**, Wu teaches that the nanowall can be an unfolded single layer. Page 65, Col. 2, Middle First Full Paragraph. Additionally, with respect to the thickness, Wu teaches that the thickness of the nanowall, which is also described as a flake, is less than 10 nanometers. Page 65, Bottom of First Full Paragraph. As per the MPEP, "where the claimed ranges overlap or lie inside ranges disclosed by the prior art a *prima facie* case of obviousness exists. MPEP 2144.05(I) (internal quotations omitted).

Additionally, the Federal Circuit has made clear that "where the only difference between the prior art and the claims [is] a recitation of the relative dimensions of the claimed device and a device having the claimed relative dimensions would not perform differently than the prior art device, the claimed device [is] not distinct from the prior art device." MPEP 2144.04(IV)(A).

Finally, as explained above, Wu's nanowalls can be considered a grouping of individual graphene layers, meaning Wu teaches a plurality of carbon nanosheets having a thickness below 1 nm or less wherein the nanosheets are aligned and stand on their edges roughly vertically to a substrate.

With respect to **claim 59**, Wu teaches that the nanowall can be an unfolded single layer. Page 65, Col. 2, Middle First Full Paragraph. Additionally, as explained above, Wu's nanowalls can be considered a grouping of individual graphene layers, meaning Wu teaches a plurality of carbon nanosheets having a thickness below 1 nm or less wherein the nanosheets are aligned and stand on their edges roughly vertically to a substrate.

With respect to **claim 75**, Wu teaches that the nanowalls are useful in catalyst materials. Page 67, Col. 1, First Paragraph.

With respect to **claim 79**, Wu teaches that the Raman spectra of the nanowalls have a peak at 1335 cm^{-1}, which is consistent with a finding that the nanowalls comprise crystalline nanowalls. Page 65, Col. 2, Bottom of the First Full Paragraph.

(4)

Claim 60 is rejected under 35 U.S.C. 103(a) as being unpatentable over Wu et al., *Adv. Mater.* **2002**, *14*, No. 1, January 4, Pages 64-67), as applied to claims 57-59, 75 and 79 above, and further in view of Peigney et al. *Carbon*, (39) 2001 505-514. Silva et al. (U.S. Publication No. 2004/0253167) will be used to support a statement of fact.

With respect to **claim 60**, Wu teaches carbon nanowalls with lateral dimensions of between 1 to 2 micrometers (which is within the claimed range of 100 nm to 8 micrometers) and that the carbon nanosheet comprises individual graphite layers, meaning the nanosheet is in substantially pure form. Wu, Figure 2 and Page 64, First Paragraph. Specifically, the nanowalls taught by Wu can be considered to be individual graphene layers that are separated from one another. Silva supports this statement of fact. Specifically, Silva teaches that carbon nanotubes comprise separated graphene layers. Paragraph 6. Accordingly, Wu's nanowalls can be considered a grouping of individual graphene layers, meaning Wu teaches a plurality of carbon nanosheets having a thickness below 1 nm or less wherein the nanosheets are aligned and stand on their edges roughly vertically to a substrate.

Additionally, it would have been obvious to a person having ordinary skill in the art at the time of invention that the specific surface area is based on the dimensions of the nanosheet and its mass. Wu teaches a substantially pure nanowall that has identical dimensions to the claimed nanosheet. Accordingly, because the nanowall is the same material and same dimensions as the claimed nanosheet, it necessarily has the same specific surface area. Specifically, the specific surface area is presumed

because both Wu and the claimed nanosheet are formed of the same material, are both in substantially pure form and both have the same dimensions. Accordingly, the nanowalls taught by Wu would be expected to have a specific surface area within the claimed range.

Moreover, it would be obvious to a person having ordinary skill in the art at the time of invention that the specific surface area, which is a function of the surface area of an object and its mass can be varied to achieve a desired result. Specifically, a person having ordinary skill in the art at the time of invention would have appreciated that the length, width, height or mass of an object could be manipulated (increased or decreased) to manipulate (increase or decrease) the obtained specific surface area. Accordingly, as per the MPEP, "where the general conditions of a claim are disclosed in the prior art, it is not inventive to discover the optimum or workable ranges by routine experimentation." MPEP 2144.05(II)(A). Moreover, a person having ordinary skill in the art at the time of invention would make this modification because Wu teaches that the nanowalls are useful in applications requiring high surface area materials. Page 67, Col. 1, First Paragraph.

Additionally, Peigney, which deals with carbon nanostructured materials, teaches that such carbon materials would be expected to have a specific surface area within the claimed range of 1,000 m^2/g to 2,600 m^2/g. Page 508, Col. 2, SSA(SWNT). Specifically, in one example, Peigney teaches that the specific surface area of a SWNT is that of one side of a graphene sheet and that the SSA is 1315 m^2/g, which is within

the claimed range. Page 508, Col. 2, SSA(SWNT). Thus, the graphene sheet taught by Wu would be expected to have the same SSA.

Therefore, it would have been obvious to a person having ordinary skill in the art at the time of invention that the nanowalls taught by Wu have an SSA within the claimed range because Wu teaches a nanowall that is made of the same material and has the same dimensions as the claimed invention, meaning SSA, which is based on surface area (length, width height) and mass would be expected to be the same. Additionally, all the parameters used to calculate SSA are result effective variables that can be optimized to obtain a SSA in the desired range. Finally, Peigney, which is a study of nanostructured carbon materials, teaches that a graphene sheet would be expected to have an SSA of 1315 m^2/g.

(5)

Claims 62-64, 76 and 80 are rejected under 35 U.S.C. 103(a) as being unpatentable over Wu et al., *Adv. Mater.* **2002**, *14*, No. 1, January 4, Pages 64-67 in view of Peigney et al. *Carbon*, (39) 2001 505-514. Silva et al. (U.S. Publication No. 2004/0253167) will be used to support a statement of fact.

With respect to **claim 62**, Wu teaches a plurality of carbon nanowalls (nanosheets) grown on a substrate wherein the plurality of nanowalls are aligned and stand on their edges vertically to the substrate. Page 64, Col. 2, Second Paragraph and Figure 1b. Wu teaches that the nanowall can be described as a flake. Page 65, Bottom of First Full Paragraph.

Furthermore, the nanowalls taught by Wu can be considered to be individual graphene layers that are separated from one another. Silva supports this statement of fact. Specifically, Silva teaches that carbon nanotubes comprise separated graphene layers. Paragraph 6. Accordingly, Wu's nanowalls can be considered a grouping of individual graphene layers, meaning Wu teaches a plurality of carbon nanosheets having a thickness below 1 nm or less wherein the nanosheets are aligned and stand on their edges roughly vertically to a substrate.

Additionally, it would have been obvious to a person having ordinary skill in the art at the time of invention that the specific surface area is based on the dimensions of the nanosheet and its mass. Wu, as explained above, teaches a flake nanowall that meets the compositional requirements of the claimed invention, meaning the nanowall taught by Wu would be expected to have the same density as that of the claimed nanoflake. Accordingly, it would be obvious to a person having ordinary skill in the art at the time of invention that the specific surface area, which is a function of the surface area of an object and its mass can be varied to achieve a desired result. Specifically, a person having ordinary skill in the art at the time of invention would have appreciated that the length, width, height or mass of an object could be manipulated (increased or decreased) to manipulate (increase or decrease) the obtained specific surface area. Therefore, because Wu teaches a nanoflake with the same density as the claimed invention, the length, width and height of the nanoflake taught by Wu could be varied along with the mass to obtain a nanoflake with the desired specific surface area. Accordingly, as per the MPEP, "where the general conditions of a claim are disclosed in

the prior art, it is not inventive to discover the optimum or workable ranges by routine experimentation." MPEP 2144.05(II)(A). Moreover, a person having ordinary skill in the art at the time of invention would make this modification because Wu teaches that the nanowalls are useful in applications requiring high surface area materials. Page 67, Col. 1, First Paragraph.

Additionally, Peigney, which deals with carbon nanostructured materials, teaches that such carbon materials would be expected to have a specific surface area within the claimed range of 1,000 m^2/g to 2,600 m^2/g. Page 508, Col. 2, SSA(SWNT). Specifically, in one example, Peigney teaches that the specific surface area of a SWNT is that of one side of a graphene sheet (equivalent to Wu's nanowall) and that the SSA is 1315 m^2/g, which is within the claimed range. Page 508, Col. 2, SSA(SWNT). Thus, the graphene sheet taught by Wu would be expected to have the same SSA.

Therefore, it would have been obvious to a person having ordinary skill in the art at the time of invention that the nanowalls taught by Wu would have an SSA within the claimed range because Wu teaches a nanowall that is made of the same material as the claimed invention, meaning SSA, which is based on surface area (length, width height) and mass would be expected to be the same can be obtained by optimizing the nanowall to a desired length, width or height. Finally, Peigney, which is a study of nanostructured carbon materials, teaches that a graphene sheet would be expected to have an SSA of 1315 m^2/g.

With respect to **claim 63**, Wu further teaches that the thickness of the nanowall, which is also described as a flake, is less than 10 nanometers. Page 65, Bottom of First

Full Paragraph. As per the MPEP, "where the claimed ranges overlap or lie inside ranges disclosed by the prior art a *prima facie* case of obviousness exists. MPEP 2144.05(I) (internal quotations omitted). Additionally, as explained above, Wu's nanowalls can be considered a grouping of individual graphene layers, meaning Wu teaches a plurality of carbon nanoflakes having a thickness below 1 nm or less wherein the nanosheets are aligned and stand on their edges roughly vertically to a substrate.

With respect to **claim 64**, Wu and Peigney, as combined above, establish that the parameters of the nanoflake (height, width, length) can be optimized to obtain a nanoflake with the desired specific surface area. Col. 1, First Paragraph. Accordingly, as per the MPEP, "where the general conditions of a claim are disclosed in the prior art, it is not inventive to discover the optimum or workable ranges by routine experimentation." MPEP 2144.05(II)(A). Moreover, a person having ordinary skill in the art at the time of invention would make this modification because Wu teaches that the nanowalls are useful in applications requiring high surface area materials. Page 67, Col. 1, First Paragraph.

With respect to the thickness of the nanoflake, Wu teaches that the thickness of the nanowall is less than 10 nanometers. Page 65, Bottom of First Full Paragraph. As per the MPEP, "where the claimed ranges overlap or lie inside ranges disclosed by the prior art a *prima facie* case of obviousness exists. MPEP 2144.05(I) (internal quotations omitted).

Additionally, the Federal Circuit has made clear that "where the only difference between the prior art and the claims [is] a recitation of the relative dimensions of the

claimed device and a device having the claimed relative dimensions would not perform differently than the prior art device, the claimed device [is] not distinct from the prior art device." MPEP 2144.04(IV)(A).

Finally, as explained above, Wu's nanowalls can be considered a grouping of individual graphene layers, meaning Wu teaches a plurality of carbon nanoflakes having a thickness below 1 nm or less wherein the nanosheets are aligned and stand on their edges roughly vertically to a substrate.

With respect to **claim 76**, Wu teaches that the nanowalls are useful in catalyst materials. Page 67, Col. 1, First Paragraph.

With respect to **claim 80**, Wu teaches that the Raman spectra of the nanowalls have a peak at 1335 cm^{-1}, which is consistent with a finding that the nanowalls comprise crystalline nanowalls. Page 65, Col. 2, Bottom of the First Full Paragraph.

(6)

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to ELI MEKHLIN whose telephone number is (571)270-7597. The examiner can normally be reached on 5/4/9.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Jennifer K. Michener can be reached on 571-272-1424. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

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